UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

3D Systems, Incorporated,	§	**Case No. 2:05-cv-74891**
Plaintiff,	§	**Hon. Avern Cohn**
v.	§	**Magistrate Judge Hon. R. Steven Whalen**
Envisiontec, Incorporated, *et al.*	§	
Defendants.	§	

SPECIAL MASTER'S REPORT AND RECOMMENDATION

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

TABLE OF AUTHORITIES

CASES

TABLE OF AUTHORITIES (cont'd)

STATUTES

I. INTRODUCTION

This is a patent case in which plaintiff, 3D Systems, Inc. ("3D"), has sued defendants, Envisiontec, Inc., Envisiontec GmbH, and Sibco, Inc. (collectively "Envisiontec"), for infringement of twelve patents. The patents in suit are directed to "stereolithography," a term that is said to have been coined by one of 3D's inventors, Charles W. Hull. The term denotes the application of lithographic techniques to the production of three-dimensional objects by solidifying successive cross sections of the object at the surface of a fluid medium in response to appropriate synergistic stimulation, such as electromagnetic radiation, *i.e.*, light, or reactive chemicals. Combined, the successively solidified cross sections form the three-dimensional object.

Of the twelve patents and their myriad claims, the district court, *per* Hon. Avern Cohn, ordered 3D to designate for trial four patents and one claim from each. 3D designated claim 11 of U.S. Patent No. 5,630,981, entitled "Method for Production of Three-Dimensional Objects by Stereolithography"; claim 2 of U.S. Patent No. 5,651,934 entitled "Recoating of Stereolithographic Layers"; claim 81 of U.S. Patent No. 5,902,537 entitled "Rapid Recoating of Three-Dimensional Objects Formed On A Cross Sectional Basis" and claim 35 of U.S. Patent No. 4,999,143 entitled "Methods and Apparatus for Production of Three-Dimensional Objects by Stereolithography."[1]

After the designation, Envisiontec identified what it considers to be the ambiguous words/phrases in each of the designated claims. 3D responded with its own interpretation of the

[1] The patents are referred to herein as the '981, '934, '537 and '143 patents, respectively. Copies of the patents, the '981 (in full); the '934 (without the software reproduced in columns 25-230); the '537 (in full); and the '143 (without appendices) are attached as Exhibits 1, 2, 3 and 4.

allegedly ambiguous words/phrases. These submissions were followed by extensive claim construction briefs filed by both parties.[2]

On February 20, 2007, the undersigned was appointed Special Master to conduct a Markman proceeding and to decide upon and recommend in writing the appropriate interpretation of the disputed claim terms. A Markman hearing was conducted on April 5, 2007. The hearing began with a short tutorial by the parties and concluded with argument by counsel on a patent-by-patent basis as to the proper construction of the disputed claim terms.

This paper constitutes my report and recommendation.

II. THE PATENTS AT ISSUE

A. Overview

The four designated patents are all directed to the stereolithographic process. The '981 Patent is directed to stereolithography in general; the '934 Patent concerns, *inter alia*, a "smoothing element" or winged blade that forms a uniform coating over each previously solidified object layer; the '537 Patent relates to the use of an applicator connected to a vacuum pump to "recoat" fresh curable liquid over each previously solidified object layer; and the '143 Patent concerns the formation of "removable supports" for the object.

B. Disclosures of the Four Patents

1. The '981 Patent

Figures 1 and 2 of the '981 Patent are self-explanatory flowcharts that illustrate the basic concepts of stereolithography.[3]

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[2] This Report and Recommendation ("Report") incorporates selected text appearing in both parties' briefs. I have done so generally on matters about which there is little dispute.

[3] A more detailed summary of the basic steps of a stereolithographic process is provided in the '934 patent:

1. Generation of a three-dimensional object design in a CAD system and storage of the design data in a CAD file;

continued ...

FIG. 1

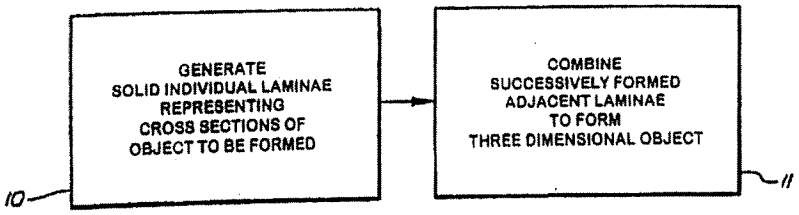
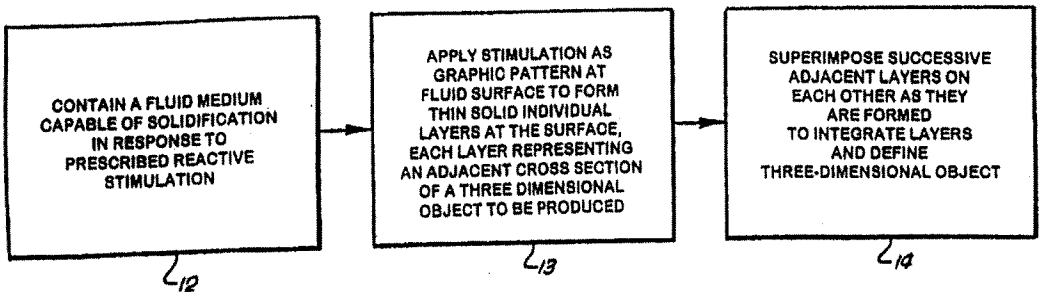


FIG. 2



According to the '981 Patent, "Many liquid state chemicals are known which can be induced to change to solid state polymer plastic by irradiation with ultraviolet light (UV) or other forms of synergistic stimulation such as electron beams, visible or invisible light, reactive chemicals applied by ink jet or via a suitable mask" ('981 Patent, col. 4, ll. 38-42).

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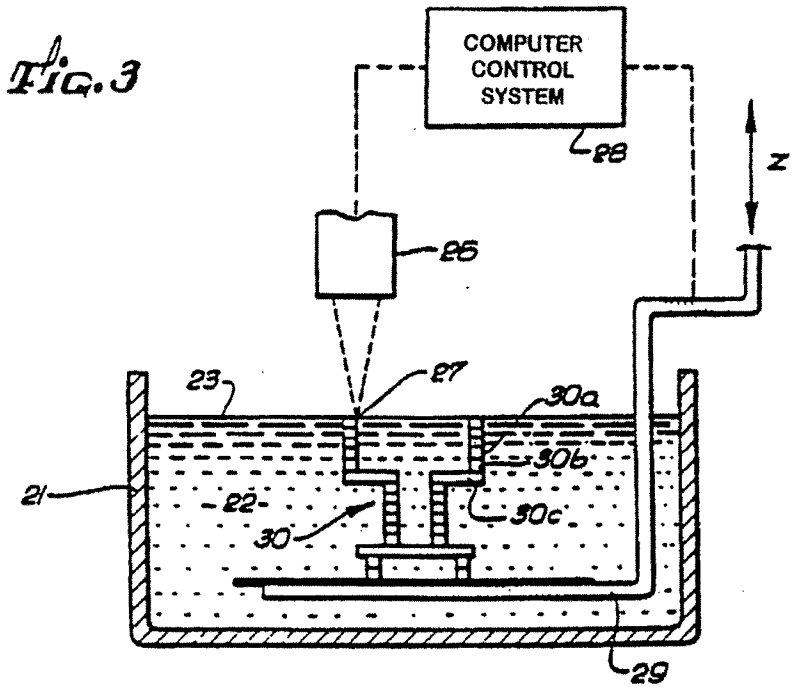
2. Compiling data from the CAD file into numerous thin "slices" each representing a thin cross sectional layer of the three-dimensional object;
3. Transfer of the compiled CAD data to a StereoLithographic Apparatus ("SLA");
4. Coating a layer of building material adjacent to a previously formed object cross section. The building material layer is preferably uniformly coated at an appropriate thickness so that the subsequently formed object cross section meets tolerance requirements;
5. Selectively exposing the building material layer to synergistic stimulation to solidify or otherwise physically transform the building material layer at those locations which collectively represent the object cross section to be formed;
6. Repeating steps (4) and (5) to alternately form successive building material layers and object cross sections until the three-dimensional object is formed; and
7. Post processing the newly-formed object by removing residual building material clinging to the object, removing the object from the platform on which it was formed, exposing the object to additional synergistic stimulation to ensure complete solidification of the building material and removing supports.

(Col. 1, ll. 31-60).

A preferred embodiment of a stereolithographic system (col. 4, ll. 15-17) is shown in FIG. 3 of the '981 Patent:



As depicted in FIG. 3, container 21 holds a photocurable liquid 22 (i.e., a liquid that can be polymerized or cross-linked to solidify upon exposure to light). The '981 Patent describes the curing process as follows:

> The light source 26 produces the spot 27 of UV light small enough to allow the desired object detail to be formed, and intense enough to cure the UV curable liquid being used quickly enough to be practical. The source 26 is arranged so it can be programmed to be turned off and on, and to move, such that the focused spot 27 moves across the surface 23 of the liquid 22. Thus, as the spot 27 moves, it cures the liquid 22 into a solid, and "draws" a solid pattern on the surface in much the same way a chart recorder or plotter uses a pen to draw a pattern on paper.

(Col. 7, ll. 20-30).

"As the liquid 22 cures and solid material forms, the elevator platform 29 that was initially just below surface 23 is moved down from the surface in a programmed manner by any

suitable actuator." *Id.* at col. 6, ll. 45-48. "The light source 26 for the presently preferred embodiment of a stereolithograph is made using a 350 watt mercury short arc lamp in a housing, with the light output of the housing focused on the end of a 1 mm diameter UV transmitting fiber optic bundle (not shown)." *Id.* at col. 7, ll. 30-34. To drive the light source, a digital plotter is used. *Id.* at col. 7, ll. 59-61.

As FIG. 3 also illustrates, the stereolithographic process uses a computer 28. Based on the computer representation of the object being built, commands are created to draw a UV light pattern for each specific layer:

> The computer 28 in the stereolithographic system of the present invention has two basic functions. The first step is to help the operator design the three-dimensional object in a way that it can be made. The second is to translate the design into commands that are appropriate for the other stereolithographic components, and to deliver these commands in a way so that the object is formed. In some applications, the object design will exist, and the only function of the computer will be to deliver the appropriate commands.

Id. at col. 8, ll. 25-33.

As the liquid 22 solidifies layer by layer, the object is built from the bottom up. Each layer is individually formed as the elevator platform 29 moves downward and liquid 22 covers the surface of the previously formed layer. The liquid is then cured or solidified by irradiation from the light beam. The elevator platform 29 then drops to receive liquid 22 for the next layer. This is known as the "recoating" process.[4] The '981 patent describes a recoating process that is sometimes referred to as "deep dipping":

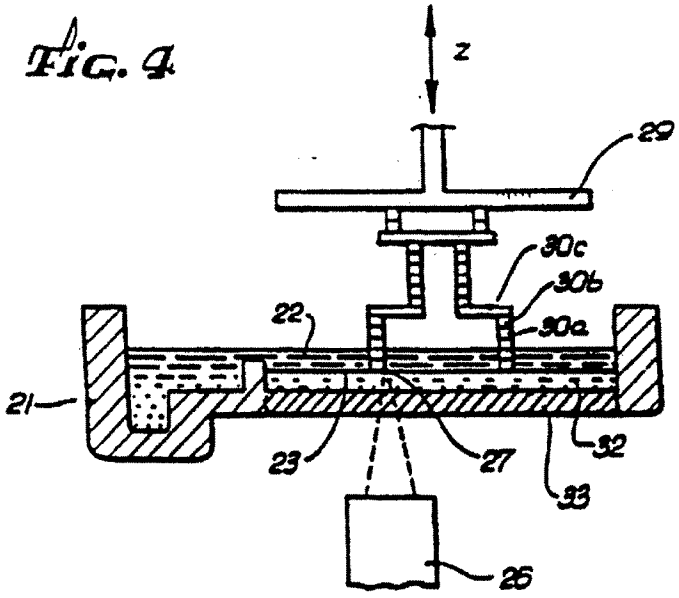
> Typically, after a layer is formed, the object 30 is moved beyond the level of the next layer to allow the liquid 22 to flow into the momentary void at surface 23 left where the solid was formed, and then it is moved back to the correct level for the next layer.

Id. at col. 8, ll. 8-12.

[4] Specific recoating processes are the subject of the '934 and '537 Patents, which are discussed *infra*.

Additional systems for implementing stereolithography are depicted in FIGS. 4-8. In FIG. 4, the object is formed from a UV light source positioned below the transparent lower wall of the container and pulled up from the liquid 22, rather than down and further into the liquid medium, as in FIG. 3. The UV light source 26 focuses the spot at the interface between the liquid 22 and a non-miscible and transparent liquid 32 on which the liquid 22 floats.

As the liquid 22 solidifies layer by layer, the object is built from the bottom down, *viz.*, each successive layer is formed beneath or under a previously solidified layer. This arrangement is said to provide an improvement over the FIG. 3 system because the "region of formation will be sharply defined and some surfaces will be formed smoother." (Col. 9, ll. 55-58).



In FIG. 5, the movable UV light source 26 of FIG. 3 is eliminated and a stationary, collimated, UV light source 35 and suitable apertured mask are substituted for the programmed source 26 and focused spot 27. The apertured mask 36 is placed as close as possible to the working surface 23, and the collimated light from the UV source 35 passes through the mask 36 to expose the working surface, thereby creating successive cross sections of the object, as in the embodiments of FIGS. 3 and 4. (Col. 9, l. 65 to col. 10, l-2).

Fig. 5

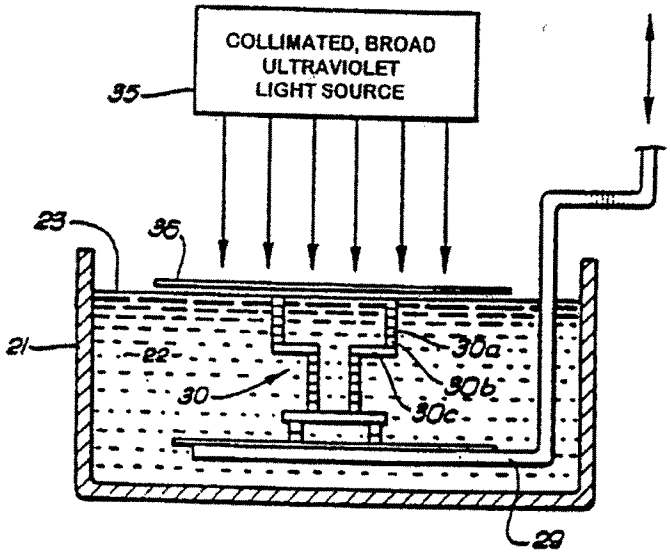
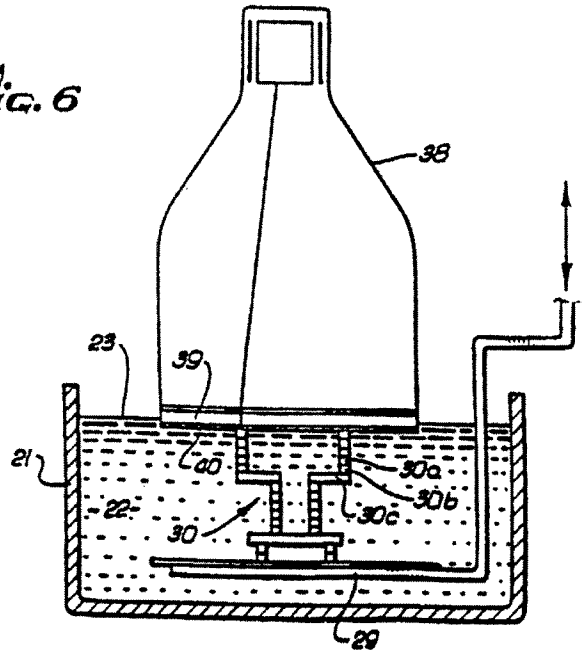


FIG. 6 shows a system in which a cathode ray tube (CRT) 38, fiber optic faceplate 39, and a release layer are provided as a substitute for the light source 26 and focus spot 27 of FIGS. 3 and 4.

Fig. 6



Finally, FIGS. 7 and 8 are identical to FIG. 3 except that in FIGS. 7 and 8 the elevator platform 29 has an additional degree of freedom. Adjustable elevator platform 29a allows for the

manual or automatic control of rotation about a pin or hinge 42. While FIG. 7 illustrates an adjustable elevator platform 29a in the conventional position, FIG. 8 shows the platform rotated 90°. The rotation permits an "add on" process whereby a supplementary, stereolithographically-formed structure is selectively formed as an addition to one side of the three-dimensional object. (Col. 10, ll. 24-42).

Fig. 7

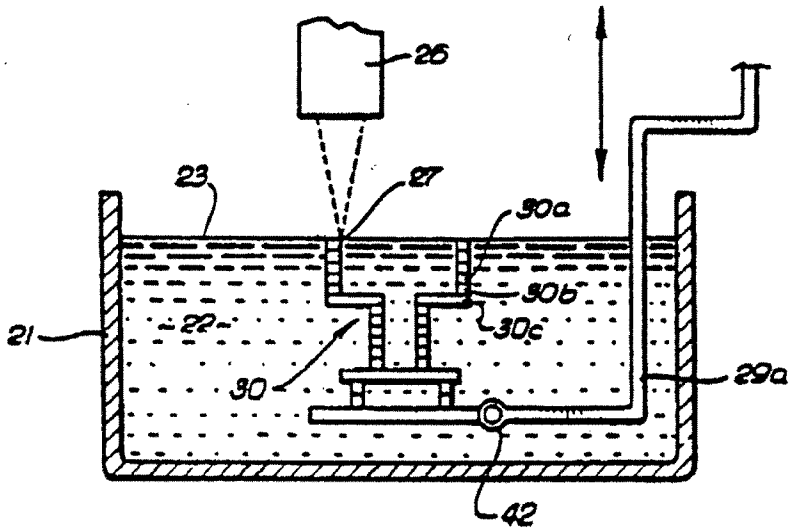
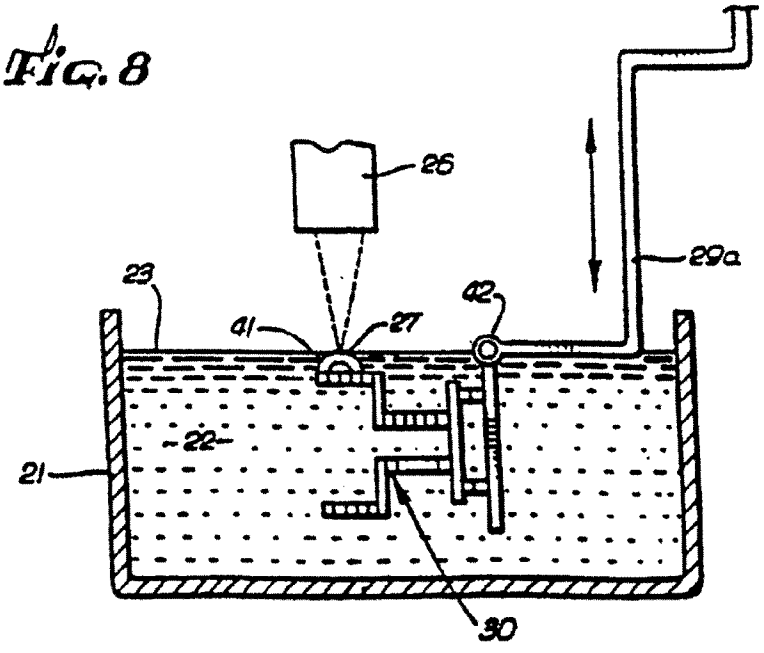


Fig. 8



2. The '934 Patent

The '934 Patent is directed to the recoating step of the stereolithography process where, after a layer of building material is cured, a new layer of uncured liquid is applied over it. Because of the viscosity of typical photocurable liquids, it can take a considerable amount of time for gravity to level the liquid, resulting in longer object build times. The '934 Patent describes the problem as follows:

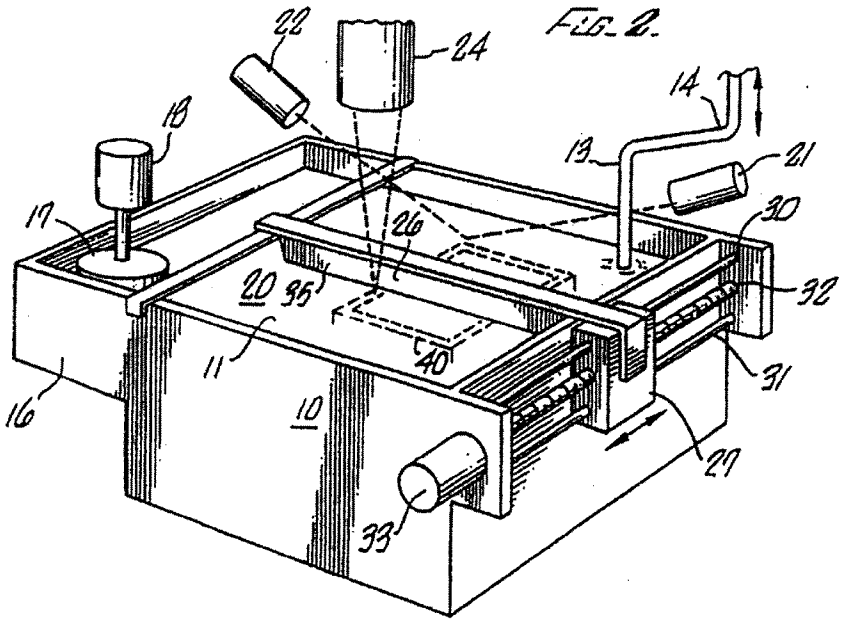
> In typical stereolithographic procedures, a thin layer of viscous curable plastic liquid is applied to a surface which may be a previously cured layer and, after sufficient time has elapsed for the thin layer of polymerizable liquid to smooth out by gravity, a computer controlled beam of radiation is moved across the thin liquid layer to sufficiently cure the plastic liquid so that subsequent layers can be applied thereto. The waiting period for the thin layer to level varies depending on several factors such as the viscosity of the polymerizable liquid, the layer thickness, part geometry, and cross section and the like.

('934 Patent, Background of the Invention, at col. 1, ll. 66 to col. 2, l-9).

"[S]tereolithographic machines require very precise control of the level of the working fluid." *Id.* at col. 4, ll. 49-50. "[T]he level of working fluid must be maintained at a constant level so that the beam of UV light will remain sharply in focus on a fixed plane." *Id.* at col. 4, ll. 56-59.

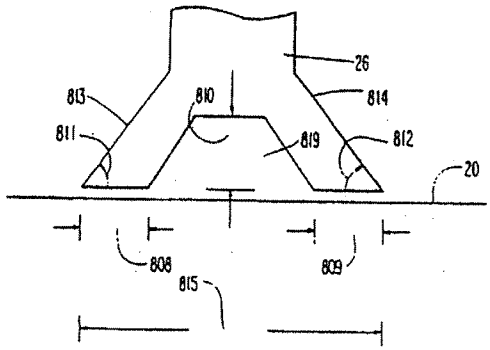
FIG. 2 of the '934 Patent illustrates an embodiment of a stereolithographic device using a doctor blade 26 mounted on the top of tank 10. The blade 26 is adapted to move horizontally across the top of the tank, (col. 8, ll. 27-8). As it moves, the blade smoothes the surface and a uniform coating over a previously formed layer of the object is created. "[D]octor blades provide means to reduce the cycle time for forming each layer of plastic." *Id.* at col. 3, ll. 40-41.[5]

[5] Doctor blades are said to have drawbacks which are discussed in detail at col. 3, l. 40 - col. 5, l. 52.



The patent describes several blade designs. FIGS. 26 and 27a depict two different embodiments of a "winged blade" design:

FIG. 26.



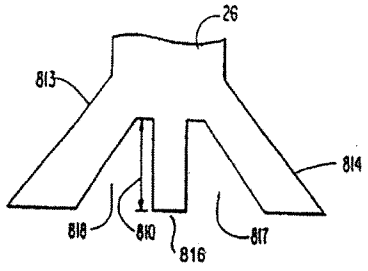


FIG. 27a

The '934 Patent describes the FIG. 26 "winged blade" design as follows:

> As shown, the preferred embodiment has two wings, identified with reference numerals 813 and 814, having sides which are at angles 811 and 812, respectively, with resin surface 20. Preferably, angles 811 and 812 are about 30°.
>
> Dimensions 808 and 809 should each be less than about 0.060 in., and preferably about 0.030 in. or less, and dimension 810 should be at least 0.010 in. or more, and preferably about 0.030 in. If dimensions 808 and 809 are too large, or if dimension 810 is too small, then layer uniformity is adversely affected. Large values of dimensions 808 and 809, or alternatively, small values of dimension 810, can result in too much blade/resin surface contact, which can induce a lift or drag force on the part, and can lead to blade/part contact for the reasons discussed previously.
>
> Dimension 815 should be greater than 0.375 in., and preferably about 0.5 to 0.75 in.
>
> This embodiment considerably reduces the leading edge deposit problem relative to simple vertical blades, and is also capable of uniform recoating of thin (0.003 to 0.005 in.) layers.

Id. at col. 233, ll. 49-67.

The FIG. 27a embodiment has a "Trident" design and is described as a variant of the FIG. 26 embodiment (col. 234, ll. 1-2).

3. The '537 Patent

The '537 Patent also relates to the recoating step in the stereolithographic process. The invention is directed primarily to improved methods and apparatus for coating a building material layer adjacent to a previously formed object cross section in preparation for forming a subsequent object cross section." (Background of the Invention, col. 2, ll. 36-39). According to the patent, "prior approaches have resulted in varying degrees of layer accuracy and non-uniformity, and/or have required excessive time to form the coatings. . . ." *Id.* at col. 2, ll. 42-45.

The use of a doctor blade may reduce coating time, but "other problems remain, such as those associated with leading edge bulge, trapped volumes, scoop-out and other problems." *Id.* at col. 3, ll. 44-49. Like the '934 Patent, the '537 Patent emphasizes that "it is important that the building material layer is uniform and of appropriate thickness so that upon solidification, the resulting object cross section exhibits dimensional accuracy." *Id.* at col. 2, ll. 47-50.

The '537 Patent discloses, *inter alia*, a recoating technique whereby an applicator is used to simultaneously apply and smooth a building material layer. The liquid material used in this process is drawn up into the applicator by a vacuum pump. FIGS. 9a and 9b of the '537 Patent illustrate the positioning of such an applicator 310 prior to (FIG. 9a) and during (FIG. 9b) the dispensing of liquid material 16.

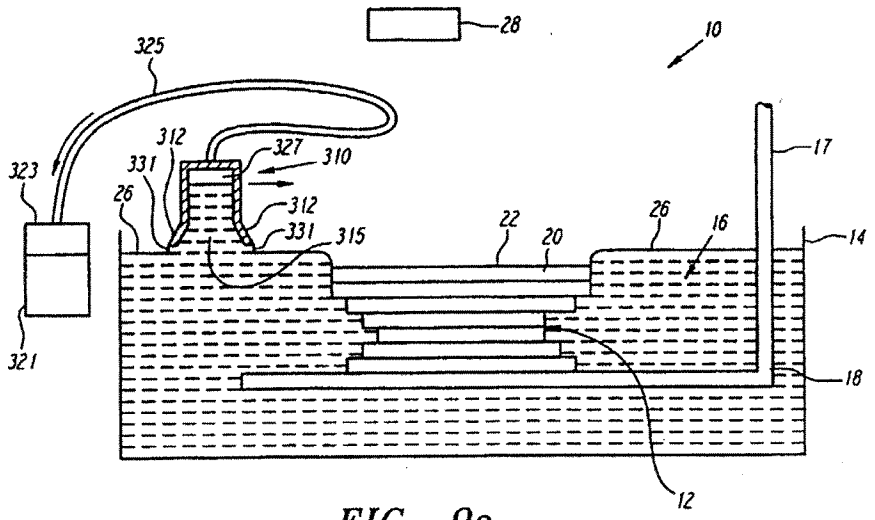


FIG. 9a

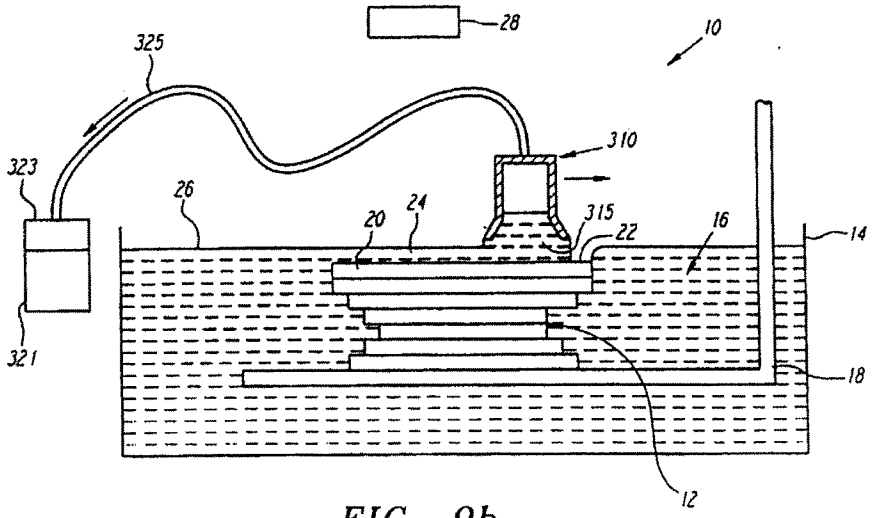


FIG. 9b

The '537 Patent describes the recoating process as follows:

> [A]pplicator 310 simultaneously applies and smoothes a building material layer 24. In a first preferred embodiment of this technique, after the last formed object cross section 20 has been formed by selectively exposing the building material to synergistic stimulation, object 12 is dipped one layer thickness, or other desired thickness, below the desired working surface 26 of building material 16. During the exposure process, applicator 310 is at least partially filled with material 16 and after the exposure process, applicator 310 is swept at or slightly above the desired working surface 26 while dispensing material from opening 315 to form building material layer 24. After dispensing of material 16, the vertical position of the upper surface 22 of the last formed object cross section 20 may be adjusted if necessary so that it is essentially one layer or other desired thickness below the desired working surface 26.

Col. 37, ll. 48-64.

According to the '537 Patent, vacuum pump 321 is used to draw liquid up into the applicator:

> In this first preferred embodiment, the resin volume in applicator 310 is maintained by vacuum pump 321, the pressure regulator 323, and vacuum feed line 325. The application of vacuum through line 325 into the upper portion of cavity 327 of applicator 310 causes a pressure differential to occur between the inside of cavity 327 and the region outside applicator 310. Applicator 310 is sealed with the exception of one or more openings near its top and with the further exception of opening 315 at its bottom.

> The openings near the top of applicator 310 provide for connection to vacuum feed line 325, while the opening at the bottom forms a slit for applicator 310 to receive and dispense building material 16.

Id. at col. 38, ll. 20-32.

As FIGS. 9a and 9b illustrate, applicator 310 dispenses layers of photocurable liquid 16. Further, a "meniscus" 331 forms and bridges a gap between the working surface 26 of the photocurable liquid and the bottom of applicator 310. The meniscus seals the applicator, and "as the pressure differential forms due to application of a vacuum at the top of the applicator 310, building material will be drawn up into applicator 310 until the pressure differential outside and inside applicator 310 is zero." *Id.* at col. 38, ll. 39-45.

4. The '143 Patent

According to the '143 Patent, "stereolithography parts are preferably built on structures known as supports, rather than directly on the elevator platform." Col. 8, ll. 12-13. The '143 Patent is directed generally to an improved support design that overcomes the problems experienced in the prior art, such as support strength limitations and required curing time. *Id.* at col. 3, ll. 14-20. Earlier prior art supports (polygonal) "were hard to remove from the object . . .offered support to only a limited number of object vectors, and required the use of a base to support the polygons to insure attachment of the perforated platform." *Id.* at col. 3, ll. 37-41.

To overcome these problems, the invention of the '143 Patent provides supports in the form of "WEBS," which, in cross section, are long slender rectangular structures. *Id.* at col. 6, ll. 52-54. "The width of a web is designed thin enough to be easy to remove from the part after post curing. The length of a web is designed to meet two requirements: (1) long enough to give good adhesion to the elevator platform (without need of a base), and (2) long enough to span the cross section of the object (to give support to cross-hatch and the boundaries enclosing it)." *Id.* at col. 6, ll. 56-61.

FIG. 9 (in part) depicts an embodiment of supports for what is said to be a "teacup." *Id.* at col. 16, ll. 10-15.

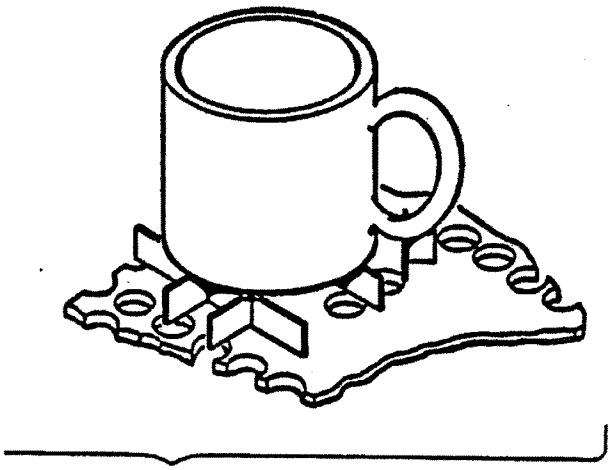


FIG. 9.

"Generally, supports are designed as a single CAD [computer-aided design] file separate from the part file." Col. 16, ll. 24-25. "The object and support files are merged and drawn as a single file later in the stereolithography process." *Id.* at col. 16, ll. 27-29. Along with the data file for the part itself, the support files are "sliced" in a computer through the use of slicing software (SLICE).

III. PRINCIPLES OF CLAIM CONSTRUCTION

A. Intrinsic Evidence is the Most Significant Source for the Meaning of the Claims

It is well-settled that the so-called "intrinsic" evidence, "*i.e.*, the patent itself, including the claims, the specification and, if in evidence, the prosecution history . . . is the most significant source of the legally operative meaning of disputed claim language." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). The intrinsic evidence is "the primary source for determining claim meaning." *AstraZeneca v. Mutal Pharm. Co.*, 384 F.3d 1333, 1336-37 (Fed. Cir. 2004). The specification, for example, "acts as a dictionary when it

expressly defines terms used in the claims or when it defines terms by implication." *Vitronics*, 90 F.3d at 1582. The specification is "[u]sually . . . dispositive . . . [and] the single best guide to the meaning of a disputed term." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (*en banc*), *cert. denied*, 126 S. Ct. 1332 (2006) (quoting *Vitronics*, 90 F.3d at 1582).

In construing the terms of a patent, a court should look first to the language of the claim itself. *Vitronics*, 90 F. 3d at 1582. The terms in the claim "are generally given their ordinary and customary meaning." *Id.* While the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art at the time of the effective filing date of the application, *Phillips*, 415 F. 3d at 1313, that inquiry must be in the context of the intrinsic evidence, and not in a vacuum. *Id.* The "ordinary meaning" is the meaning to an ordinary artisan "after reading the entire patent." *Id.* at 1321.

The claims must be construed from the perspective of a person of ordinary skill in the art at the time of the invention. A court "must look at the ordinary meaning in the context of the written description and the prosecution history." *Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1319 (Fed. Cir. 2005). "In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words." *Phillips*, 415 F.3d at 1314.

The Federal Circuit has also emphasized that where the proper meaning of a claim term is understandable to the jury without explanation, no claim construction is necessary and none should be given:

> The *Markman* decisions do not hold that the trial judge must repeat or restate every claim term in order to comply with the ruling that claim construction is for the court. Claim construction is a matter of resolution

> of disputed meanings and technical scope, to clarify and when necessary to explain what the patentee covered by the claims, for use in the determination of infringement. It is not an obligatory exercise in redundancy.

U.S. Surgical Corp. v. Ethicon, Inc., 103 F.3d 1554, 1568 (Fed. Cir. 1997). *See also British Telecommunications PLC v. Prodigy Comm'ns Corp.*, 189 F. Supp. 2d 101, 119 (S.D.N.Y. 2002)(the court declined to construe a simple phrase because "[i]t is not a technical term; the simple English words contained in the phrase need no particular defining, and it can be understood without recourse to any other material.")

B. Limitations From the Specification Should not be Read Into the Claims

Reading limitations from the patent specification into the claims is one of the "cardinal sins" of patent law. *Phillips*, 415 F.3d at 1320. The Federal Circuit has "repeatedly warned against confining the claims to [specific] embodiments" because "claims may embrace different subject matter than is illustrated in the specific embodiments in the specification." *Id.* The court has "expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." *Id.* at 1323; *Constant v Advanced MicroDevices Inc.*, 848 F.2d 1560, 1571 (Fed. Cir. 1988); and *Sjolund v. Musland*, 847 F.2d 1573, 1581 (Fed. Cir. 1988).

While it is proper to use the specification to interpret what the patentee meant by a word or phrase in the claim, this should not be confused with adding an extraneous limitation appearing in the specification, which is improper. *E.I. Du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed. Cir. 1988).

> If everything in the specification were required to be read into the claims, or if structural claims were to be limited to devices operated precisely as a specification-described embodiment is operated, there would be no need for claims. Nor could an applicant, regardless of the prior art, claim more

> broadly than that embodiment. Nor would a basis remain for the statutory necessity that an applicant conclude his specification with "claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as the invention."

SRI Int'l v. Matsushita Elec. Corp., 775 F.2d 1107, 1121 (Fed. Cir. 1985).

C. Construction of Means-Plus-Function Claim Language

Terms in a patent may be expressed in means-plus-function language. 35 U.S.C. § 112, ¶6. The construction of means-plus-function limitations involves two steps. First, the court must identify the claimed function. The court must construe the function of the means-plus-function limitation to include only the function contained in the claim language, and not to narrow or broaden the scope of the function beyond the claim language. Second, once the claim function has been identified, the court must then determine what structure disclosed in the specification is the means that performs the claimed function. *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 296 F.3d 1106, 1113-14 (Fed. Cir. 2002). The means-plus-function limitation is construed to cover all structures described in the patent specification as performing the claimed function, and equivalents thereof. *See Vulcan Eng'g Co. v. Fata Aluminum, Inc.*, 278 F.3d 1366, 1373-74 (Fed. Cir. 2002).

IV. CONSTRUCTION OF THE DESIGNATED CLAIMS

A. Claim 11 of the '981 Patent

Claim 11 depends from claim 10 and limits the terms "medium" and "prescribed radiation" in claim 10 to a photopolymer and light, respectively. So limited, claim 11 can be rewritten as follows, with disputed claim terms appearing in boldface:

11. [A method of **producing a three-dimensional object** from a [medium] photopolymer capable of selective physical transformation.

when **subjected to [prescribed radiation] light** said method comprising the steps of:

(1) providing said [medium] photopolymer**:**

(2) **providing said [prescribed radiation] light**;

(3) **providing data representing the three-dimensional object to be formed which was generated on CAD system**;

(4) **forming a first cross sectional layer of structure by exposing said [medium] photopolymer to said [prescribed radiation] light**;

(5) **forming successive layers of [medium] photopolymer** adjacent to any **previously formed cross sectional layers** of structure

(6) **forming and adhering successive cross sectional layers** of structure by **exposing said medium to said prescribed radiation in response to said data,** whereby a **plurality of adhered cross sectional layers** of structure form the three-dimensional object.

1. "Producing a Three-Dimensional Object"

Envisiontec interprets this phrase to mean "moving a beam of light across the surface of a photopolymer to create a solid object by drawing a light pattern thereon." 3D argues that the phrase is clear as written and requires no interpretation. I agree with 3D. The phrase "producing a three-dimensional object" in the context of the disclosure of the '981 Patent is clear and understandable.

Envisiontec's argument is a syllogism that is repeated throughout its claim construction brief with respect to the appropriate scope of all the designated patents. The premise is that 3D's patents cover stereolithography; stereolithography is limited to the use of radiation beams that draw a pattern as they move across the surface of a curable liquid; and, therefore, 3D's patents are limited to the use of such radiation beams and no other sources of synergistic stimulation. The first half of the premise is correct, but the second half of it is wrong for several reasons.

The specification and drawings of the '981 Patent are replete with text and illustrations demonstrating the inventor's intent to claim his invention broadly and not limit his invention to

one or more embodiments or one or more techniques to physically transform the curable medium. For example, the Summary of the Invention describes the invention as "the application of lithographic technique to the production of three-dimensional objects, to simultaneously execute computer aided design (CAD) and computer aided manufacturing (CAM) in producing three-dimensional objects directly from computer instructions." ('981 Patent, col. 2, ll. 36-42).

Likewise, the flowcharts of Figures 1 and 2 are said to illustrate "the basic concepts employed in practicing the method of stereolithography of the present invention. (Col. 4, ll. 13-15). Neither flowchart limits the manner in which the individual layers are cured at the surface of the fluid medium in response to "prescribed reactive stimulation" (FIGS. 1-2).

Further, FIG. 5 of the '981 system is said to disclose a system similar to that of FIG. 3, "but the movable UV light source 26 [of FIG. 3] is eliminated and a collimated, broad UV light source 35 and suitable apertured mask 36 is substituted for the programmed source 26 and focused spot 27." (Col. 9, ll. 61-65). *See* also the Abstract (cover page); Summary of the Invention, col. 2, ll. 25-32; col. 2, ll. 63 to col. 3, l2; Description of the Preferred Embodiment, col. 5, ll. 5-67; and the repeated references to the systems of FIGS. 3-8 as preferred and alternative embodiments of the invention.

Finally, the '981 Patent issued on the last application in a long series of applications dating back to August 8, 1984. (Cover page, col. 1). Envisiontec has not pointed to a single instance in the prosecutions of the '981 Patent or its predecessor applications where delimiting statements or concessions were made by 3D as to the breadth of the invention disclosed in the '981 Patent. The '981 Patent discloses a broad invention and claims it broadly.

With the one exception identified below, the remaining limitations of claim 11 require no clarification or interpretation.

2. "Subjected to Light" and "Providing Said Light"

Here, again, Envisiontec would interpret these phrases as incorporating a beam of light that moves across the surface of the photopolymer. I disagree with this interpretation for the reasons explained above.

3. "Providing Data Representing the Three-Dimensional Object to be Formed Which Was Generated on CAD System"

Envisiontec interprets this limitation to mean "supplying an object representation comprising horizontally-sliced object sections of constant thickness." 3D interprets this limitation to mean "providing design data corresponding to the object." Neither interpretation is correct. The limitation should be interpreted as though it included the qualifying phrase "adjacent cross sectional layers of" after the word "representing." With this inclusion, this claim step would read: providing data representing adjacent cross sectional layers of the three-dimensional object to be formed which was generated on CAD system."

This interpretation provides consistency to the claim and fully comports with the invention that is disclosed in the '981 Patent. As noted earlier, the flowcharts of Figures 1 and 2 illustrate "the basic concepts employed in practicing the method of stereolithography of the present invention." (Col. 4, ll. 12-14). Referring to Figure 1, the patent states that the "stereolithographic system of the present invention generates three-dimensional objects by creating a cross sectional pattern of the object to be formed at a selected surface of a fluid medium." (Col. 5, ll. 13-17).

Additionally, the sixth and last limitation of claim 11 sets forth the step of "forming and adhering successive cross sectional layers . . . by exposing the photopolymer to said light in response to said data." The antecedent for the term "said data" is the data referred to in step 3 of

claim 11. In the circumstances, the data representing the three-dimensional object referred to in step 3 must be data that is representative of adjacent cross sectional layers of the object.

3D argues that the "data" referred to in step (3) represents the design of the object and not the data compiled from the CAD file into "slices," each slice representing a thin cross sectional layer of the three-dimensional object. As to the description in step (6), that the cross sectional layers are formed by exposing the photopolymer to light in response to said data, it is 3D's position that the object data is broadly responsible for the formation of the cross sectional layers because the slice data is derived from the object data. However, the step of compiling the data into slices which is omitted in 3D's analysis is crucial to the formation of the cross sectional layers of the three-dimensional object. Thus, the construction that 3D has proposed is inconsistent with the invention of the '981 patent and inconsistent with the plain wording of claim 11.

The case *Rambus vs. Infineon Techs. AG,* 318 F.3d 1081 (Fed. Cir. 2003), is not to the contrary. There, the district court interpreted the term "read request" as synonymous with the term "request packet"; yet the patent specification, as well as the claims, drew a clear distinction between the two terms, 318 F. 3d at 1092-93. The law is clear that patent claims need not necessarily recite every feature necessary to enable operation of a working device, 318 F. 3d at 1093. However, the slicing step which I have found explicit in claim 11 and which 3D claims to have been rightfully omitted from claim 11 is crucial to the patentability of the claim under 35 U.S.C. § 112.

4. "Forming a First Cross Sectional Layer of Structure by Exposing Said [Medium] Photopolymer to Said [Prescribed Radiation] Light"

Defendants would modify this limitation to mean that a first "horizontal slice of constant thickness is formed by a moving beam of light." I disagree with this proposed modification.

The specification arguably discloses the formation of at least diagonal layers (FIGS. 7-8), and, in any event, absent good reason, claims should not be limited to their preferred embodiment. *See Agfa Corp. v. Creo Products, Inc.*, 45 F.3d 1366 (Fed. Cir. 2006). Once again, I find no reason to rewrite, as an exercise in claim construction, an unambiguous phrase.

5. "Forming a First Cross Sectional Layer of Structure by Exposing Said [Medium] Photopolymer to Said [Prescribed Radiation] Light;"

"Forming Successive Layers of [Medium] Photopolymer Adjacent to Any Previously Formed Cross Sectional Layers of Structure;"

"Forming And Adhering Successive Cross Sectional Layers of Structure by Exposing Said [Medium] Photopolymer to Said [Prescribed Radiation] Light in Response to said data, Whereby a Plurality of Adhered Cross Sectional Layers of Structure Form the Three-Dimensional Object"

The foregoing steps can be conveniently grouped together to avoid redundancy. I have already addressed Envisiontec's argument that the cross sectional layers should be limited to those having a horizontal orientation. There is no reason to limit the layers to those having a horizontal orientation nor reason to limit them to those having a constant thickness. The proposed limitations cannot be supported by reference to the '981 patent specification and are not consistent with the breadth of the invention disclosed in the '981 patent specification.

Envisiontec argues that the term "adhering" appearing in the last step of claim 11 should be construed to mean "adhesively attaching" successive horizontally-sliced object sections of constant thickness. As the basis for this argument, Envisiontec points to the specification of the '981 Patent, col. 6, ll. 60-64, where it is said that the curable liquid "must be adhesive, so that successive layers will adhere to each other." However, Envisontec's inclusion of the word "adhesive" unduly narrows the term "adhering." 3D argues that the term "adhering" means

"integrating." The definition is plausible but unnecessary. The word "adhere" is a commonly understood word. No interpretation of the word is therefore required.

Nor does the term "cross sectional" require interpretation. In the context of the '981 Patent, cross sectional layer is a section of the three-dimensional object made by a plane cutting through the object.

B. Claim 2 of the '934 Patent

Claim 2 depends from claim 1 and limits the "smoothing element" of claim 1 to a "winged blade." So limited, claim 2 can be rewritten as follows, with disputed claim terms appearing in bold face.

2. [A method for **stereolithographically forming a portion of a three-dimensional object**

wherein a **subsequent layer** of the three-dimensional object

is **formed over** a

previously formed layer of the object, comprising the steps:

a) holding a volume of a building material having a working surface wherein the building material is capable of selective physical transformation upon **exposure to prescribed synergistic stimulation**;

b) **forming a uniform coating of desired layer thickness over the previously formed layer**,

including **sweeping a [smoothing element] winged blade** at least once

over the previously formed layer

said [smoothing element] winged blade having a plurality of substantially separate members on a lower surface thereof for contacting the building material; and

c) **applying a prescribed pattern of synergistic stimulation to the building material at the working surface to transform at least a portion of the building material to form the subsequent layer**

1. "Stereolithographically Forming a Portion of a Three-Dimensional Object"

This phrase refers to the basic concept of stereolithography disclosed in the '981 Patent, discussed above, and U.S. Patent No. 4,575,330 entitled "Apparatus for Production of Three-Dimensional Objects by Stereolithography," containing virtually the same, if not identical, disclosure as the '981 patent, and incorporated by reference into the '934 Patent. Envisiontec argues that the only embodiment of a stereolithographic system disclosed in the '934 Patent involves the use of a radiation beam that transverses the surface of the curable liquid and for this reason the preamble should be so limited. The argument is of no moment. Incorporation by reference of the '330 patent, with its broad disclosure, including the FIGS. 1 and 2 flowcharts and the FIG. 5 system in which a stationary source of collimated, broad ultraviolet light is used as the source of the synergistic stimulation, contradict the narrowing interpretation that Envisiontec proposes.

2. "Subsequent Layer" and "Formed Over a Previously Formed Layer"

Envisiontec argues that the term layer as it is used in the preamble means a section of constant thickness." Such interpretation is an unnecessary narrowing of the term layer and is inconsistent with a later express narrowing of the term layer in step (b) of the claimed method.

As to the description in the preamble that the subsequent layer is "formed over a previously formed layer," the use of the term "formed over" limits the stereolithographic process to one in which the three-dimensional object is dropped down further into the liquid medium with each layer being solidified on top of a previously solidified layer, rather than pulled up from the liquid medium with each layer formed beneath a previously solidified layer. Thus, the phrase should be construed to mean "formed on top of."

This limitation on the breadth of the stereolithographic process is unsurprising given the nature of the invention disclosed in the '934 patent and the fact that each of the Figures of the '934 patent illustrates a system in which each cross section is formed over or on top of the previously formed layer. It is also important to note the change in relational terms used in the broad '981 patent and the '934 patent. Rather than use the word adjacent to describe the physical relationship between the layers, as in the '981 Patent, the preamble of the '934 Patent uses the phrase "formed over."

The specification of the '934 Patent uses the word "over" in its normal sense to mean "on top of." The '934 Patent describes the stereolithography process as follows:

> Basically, stereolithography is a method for automatically building complex three-dimensional parts (e.g., plastic parts) by **successively curing** a plurality of **thin layers** of a curable medium (e.g., polymerizable liquid) **on top of each other** until all of the thin layers are joined together to form a whole part.

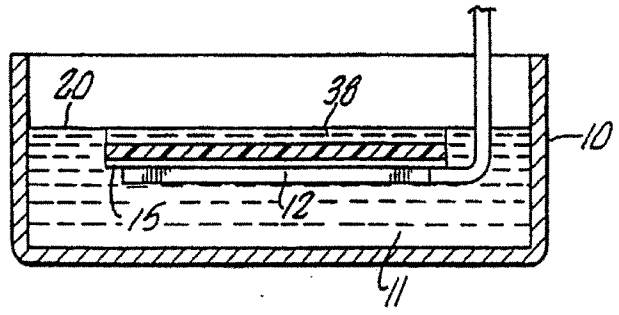
Background of the Invention, col. 1, ll, 28-33.

In the corresponding description of FIG. 6 (reproduced below), it is stated:

> After irradiation of layer 34, the object support platform 12 is further lowered as shown in FIG. 6 so that the liquid from the bath 11 flows over the previously cured layer 34 to form a new layer 38 to thereby initiate another cycle of the process.

Id. at col. 9, ll. 26-30.

FIG. 6.



"[T]he specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication." *Phillips v. AWH Corp., et al.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (citations omitted). In this case, the '934 Patent specification makes clear that "formed over" refers to the solidification of object layers on top of previously solidified layers.

3. "Exposure to Prescribed Synergistic Stimulation"

The phrase "exposure to prescribed synergistic stimulation" is said by Envisiontec to be ambiguous. Once again, Envisiontec argues that the prescribed synergistic radiation is limited to a beam of radiation that moves across the surface of the curable liquid. For the reasons I have already explained, I disagree. The term embraces electromagnetic radiation emitted by stationary and moving light sources, particle beams and reactive chemicals.

4. "Forming a Uniform Coating of Desired Layer Thickness Over the Previously Formed Layer"

3D would modify the word "uniform" to mean "substantially consistent," while Envisiontec would read a "deep dipping" coating process into this step. After considering the interpretations of both parties, I have concluded that the term "uniform," in the context of the '934 patent, means a "smooth, level" coating. Further, after the word "coating" the phrase "of uncured building material" could be added for even greater clarity of meaning.

The '934 patent discusses at great length the use of a smoothing member -- a doctor blade -- for "forming a uniform coating over a previously formed layer of the object," (Abstract, cover). Use of the doctor blade, as described with respect to FIG. 4, for example, entails sweeping the blade across the surface of the uncured liquid so that the lower edge of the blade strikes off excess polymerizable liquid from the layer. The sweeping blade "thereby *smooths the upper surface (36) of the coating of material* over surface 15." (Col. 8, ll. 58-62, emphasis

added). Further, the '934 patent states, "Suitable blade speeds are empirically determined *to provide a desired level to the upper surface* 36. Moreover, one or more passes by the doctor blade 26 may be needed at a particular speed *to provide a smooth level upper surface 36 of coating 34*." (Col. 8, 62-66, emphasis added).

5. "Sweeping a [Smoothing Element] Winged Blade At Least Once Over the Previously Formed Layer, said [Smoothing Element] Winged Blade Having a Plurality of Substantially Separate Members"

This step means a device having two wings with sides that are at angles with respect to the surface of the material is moved across the upper surface of uncured building material to sweep away excess curable liquid and thereby create a uniform coating of desired or predetermined thickness over the previously cured layer of building material.

6. "Applying a Prescribed Pattern of Synergistic Stimulation to the Building Material at the Working Surface to Transform At Least a Portion of the Building Material to Form the Subsequent Layer"

This step in the claimed method of the '934 patent is not limited to the use of a radiation beam that is moved across the surface of the curable liquid, as I have already explained. Rather, the step encompasses the various sources of synergistic stimulation disclosed in the '934 and '330 patents, including a stationary source of collimated light. "To form the subsequent layer" means simply the solidification of the uniform coating of desired layer thickness.

C. Claim 81 of the '537 Patent

Claim 81 of the '537 Patent, with disputed claim terms appearing in boldface, reads as follows:

81. An apparatus for **forming at least a portion of a three-dimensional object** on a substantially **cross sectional basis**

from a material capable of physical transformation upon **exposure to synergistic stimulation,** comprising:

means for supplying data descriptive of the object;

a container for containing a volume of material having a working surface;

an applicator

for **forming layers** of material

over at least portions of previously formed object cross sections, the applicator having a bottom opening located in proximity to the working surface;

a **vacuum pump** coupled to the applicator for drawing up material from the working surface through the bottom opening and into the applicator;

means for sweeping the applicator across at least a portion of at least some of the previously formed object cross sections; and

a **source of synergistic stimulation**

for **exposing the layers according to the descriptive data** to form the at least portion of the object from

a **plurality of object cross sections**.

The preamble of claim 81 describes stereolithography as that term has been defined and used consistently throughout the four patents that 3D has designated for trial. I find that the preamble is fairly descriptive of the stereolithographic process. To the extent that the preamble might be clarified for ease of understanding, it can be rewritten this way:

> An apparatus for making all or part of a three-dimensional object by solidifying successive cross sections of the object from a curable liquid upon exposure to synergistic stimulation.

1. "Means for Supplying Data Descriptive of the Object"

35 U.S.C. § 112 governs the interpretation of this claim element. I interpret the means to be a computer or equivalent that supplies data that is descriptive or representative "of adjacent cross sectional layers." This interpretation is consistent with the invention of the '537 Patent and

provides an antecedent basis for the function of the source of synergistic stimulation claimed in the last element of claim 81.

3D would interpret this limitation to mean a computer or CAD file that stores design data representing the object. However, as I have explained earlier in this report with respect to the '981 Patent, storing data relating to the design of a three-dimensional object in a CAD or similar file is not the technological advance to which stereolithography is directed. The technological advance is the conversion or compilation of the data into numerous thin slices, each representing a cross sectional layer of the object. 3D's interpretation would also leave the claim open to an invalidity attack under 35 U.S.C. § 112. I say this because the last limitation of claim 81 describes the source of synergistic stimulation as "exposing the layers according to the descriptive data." The layers of uncured building material are exposed according to the data representative of adjacent cross sectional layers and not the design of the object.

2. "An Applicator"

The parties agree that the element is a device that applies and smoothes the building material.

3. "For Forming Layers of Material Over At Least Portions of Previously Formed Object Cross Sections"

Interpreting this disputed function in light of the specification, the function may be expressed as "coating a building material layer on top of part or all of a previously solidified object cross section." My reasons are explained below.

The invention of the '537 Patent is directed to the function of "coating a building material layer adjacent to a previously formed object cross section in preparation for forming a subsequent object cross section" (col. 2, ll. 36-40). The '537 Patent discloses the formation of

layers on a cross sectional basis, one adjacent the next. Liquid coating is applied to the working surface or top of the last-formed object cross section. (Col. 7, ll. 13-17 and 22-23).

Envisiontec would include the phrase "of constant thickness" after the word "material." There is no basis for the added limitation. As the patent explains, it is for the purpose of "dimensional accuracy" that the building material layer be "uniform and of appropriate thickness." (*Id.* at ll. 47-50). Where building material layer thickness varies from the desired thickness, measures may be taken to rectify the thickness errors. (FIG. 1, col. 7, l. 65 - col. 8, l. 50).

Envisiontec would also limit the object cross sections to "horizontally-sliced object sections." Defendants' reading is inconsistent with the specification of the '537 Patent and FIG. 8 of the '330 patent, which shows that object sections can be formed that are not horizontal to the vertical axis of the three-dimensional object.

4. "Vacuum Pump"

The definition of vacuum pump is found in the '537 patent. It means a device that creates a difference in pressure. It is because of the pressure difference that "building material will be drawn up into applicator 310" ('537 Patent, col. 38, ll. 20-45, and *see* Figure 9i).

5. "Means For Sweeping the Applicator Across at Least a Portion of at Least Some of the Previously Formed Object Cross Sections"

The '537 Patent does not describe a specific "means for sweeping." Instead, it refers to a "frame and drive system" that is *not shown*. (Col. 37, ll. 65-67) However, the '537 Patent at col. 3, ll. 9-33 incorporates by reference U.S. Patent No. 5,174,931, which depicts the means for sweeping as follows:

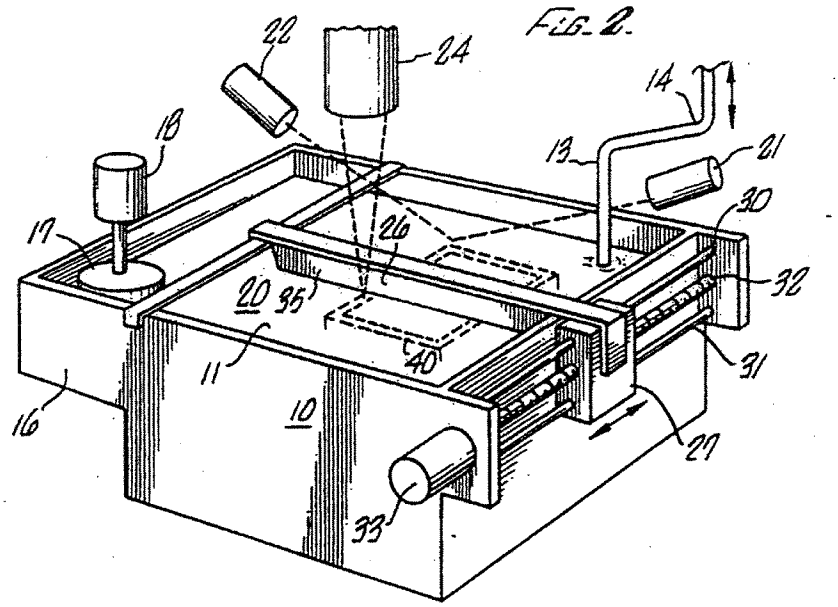


FIG. 2 is described as follows in the '931 patent:

> A doctor blade 26 is mounted on top of the tank 10 and is adapted to move horizontally across the top of the tank. A blade support 27 is solidifiably mounted on rails 30 and 31 disposed along one side of the tank 10. A threaded drive shaft 32 passes through a threaded passageway (not shown) in the blade support 27 and rotation thereof by motor 33 moves the blade support 27 and thus the blade 26 horizontally across the top of the tank 10.

'931 Patent at col. 8: ll. 17-26.

The relevant "structure" for purposes of a means-plus-function limitation is the "corresponding structure necessary to accomplish the stated function." *Gemstar-TV Guide International, Inc., et al. v. International Trade Comm.*, et al., 383 F.3d 1352, 1361 (Fed. Cir. 2004). As shown in FIG. 2, the motor-driven rotation of the threaded drive shaft 32 causes the claimed applicator to sweep. Therefore, the construction of "means for sweeping . . . " must include the threaded shaft. Indeed, the only *structure* disclosed for performing the sweeping function is a motor-driven threaded drive shaft.

The language of this means-plus-function element may thus be defined as a "frame and motor-driven threaded shaft system" and equivalents thereof that perform the sweeping function recited in the claim.

6. **"A Source of Synergistic Stimulation"**

This element means a device that generates synergistic stimulation. Nothing has been brought to my attention that would require an interpretation of this element to mean a moving beam of radiation.

7. **"For Exposing The Layers According to the Descriptive Data, to Form the at least Portion of the Object from a Plurality of Object Cross Sections"**

As discussed above with respect to the first element of claim 81 and throughout this report, this function may be interpreted to read:

> for exposing the layers of curable liquid according to the data descriptive of the cross sections of the object to form the at least portion of the object from a plurality of object cross sections.

D. Claim 35 of the '143 Patent

Claim 35 depends from claim 28. Claim 35, including the disputed claim terms of claim 28, appear in boldface as follows:

35. [An apparatus for **producing a three-dimensional object** from a medium capable of selective physical transformation

upon **exposure to synergistic stimulation**

from an object representation specifying a first object surface to be spaced from a second surface by a spacing, and at least partially opposing the second surface, comprising:

at least one **computer programmed to form a support representation**

specifying a **removable support**

to be **formed in said spacing out of a material substantially layer by layer,**

said support in cross sectional width being **thin**, and comprising a solid which extends along a path connecting said first and second surfaces, the path having a vertical path component which is greater than any horizontal path component; and

means for receiving said support representation, and for forming said three-dimensional object out of said medium substantially layer by layer and also for forming said support out of said material substantially layer by layer, in accordance with said object and support representations];

The limitations at issue appearing in the preamble of claim 28, from which claim 35 depends, are addressed below:

1. **"Producing A Three-Dimensional Object" and "Exposure To Synergistic Stimulation"**

The phrases "producing a three-dimensional object" and "exposure to synergistic stimulation" are unambiguous and need not be interpreted or limited, as defendants would have it, to the use of a moving beam of radiation, as I have explained, passim. For clarity, I interpret the term "spacing" as the location where a support for the object will be formed.

2. **"From an Object Representation"**

Here , again, this phrase must be construed to mean data that represents adjacent or successive cross sections of the object. The compilation of the object data into slices or layers is crucial to the disclosed stereolithographic process. Such a meaning also comports with the description in claim 35 of the receiving and forming means as comprising "means for forming said object substantially layer by layer."

3. **"At Least One Computer Programmed to Form a Support Representation"**

This claimed element is expressed clearly. It means what it says, namely, a computer programmed or having instructions to produce data relating to a support for the three-dimensional object.

4. "Specifying a Removable Support"

The parties are close to agreement as to the meaning of this term. In the context of the '143 Patent and as plainly written, a removable support is a structure that is not a part of the finished object and which provides reinforcement to the object or portions of the object and can be separated from the object.

5. "To be Formed in said Spacing Out of a Material Substantially Layer by Layer"

Here, again, the parties are close to agreement as to the meaning of this phrase. In the context of the '143 Patent, the phrase means "created in the space between the first and second surfaces by successively solidifying curable liquid cross sections."

6. "Said Support in Cross Sectional Width Being Thin and Comprising a Solid Which Extends Along a Path Connecting said First and Second Surfaces, the Path Having a Vertical Path Component which is Greater than any Horizontal Path Component"

In the context of the '143 Patent and its file history, the word "thin" means substantially smaller in width than in height to facilitate the easy removal of the support from the object. The basis for this interpretation appears in the Summary Of The Invention of the '143 Patent:

> In accordance with the invention, supports are provided in the form of "WEBS". Webs, in cross section are long slender rectangular structures. The width of a web is designed thin enough to be easy to remove from the part after post curing. The length of a web is designed to meet two requirements: (1) long enough to give good adhesion to the elevator platform (without need of a base), and (2) long enough to span the cross section of the object (to give support to cross-hatch and the boundaries enclosing it).

(Col. 6, ll. 52-61).

Additionally, the specification of the '143 Patent states, "The most practical type of support is the thin, vertical web shown in the previous illustrations." ('143 col. 16, ll. 18-19). The illustrations referred to are FIGS. 7, 8, and 9, reproduced below:

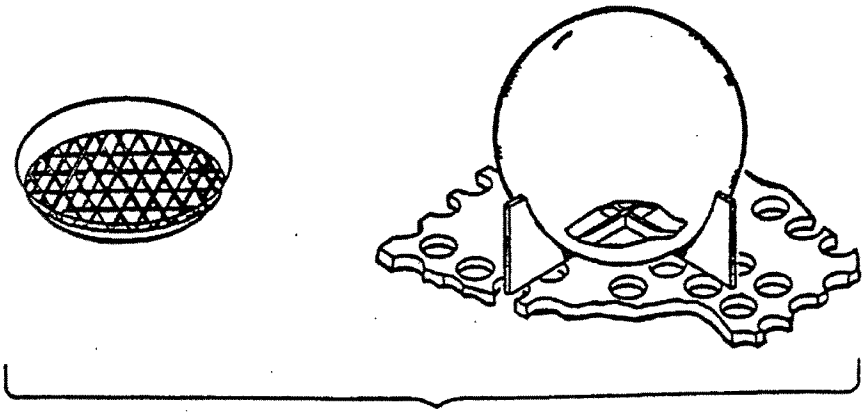
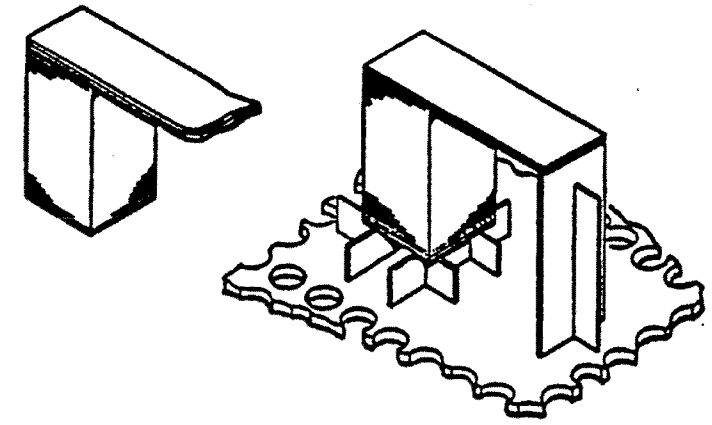


FIG. 7.

FIG. 8.



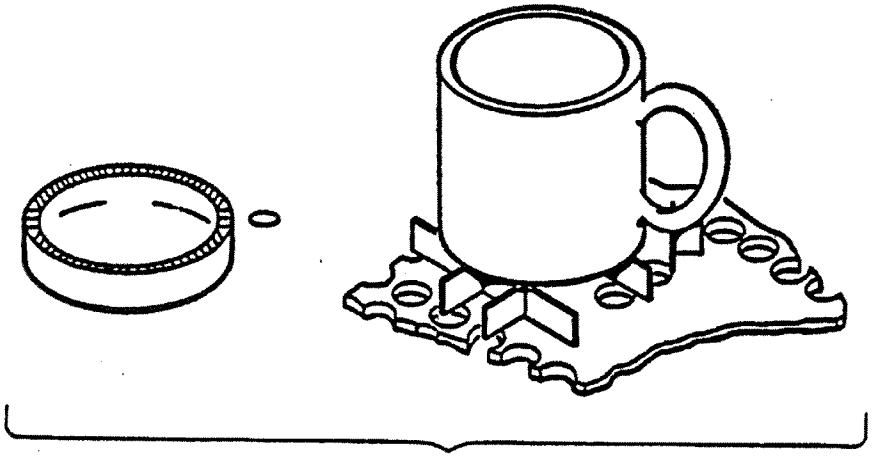
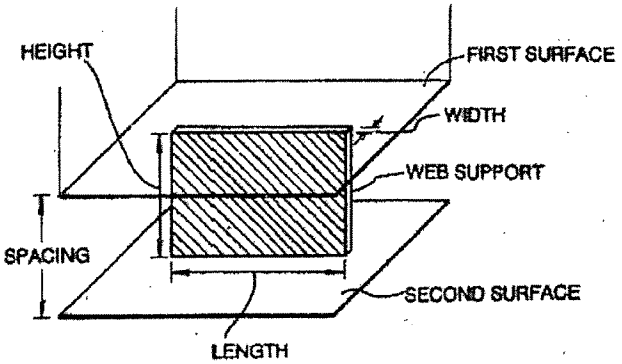


FIG. 9.

In each case, the support in cross section is indeed "substantially lesser in width than in length."

Finally, the prosecution history of the '143 Patent comes into play. Following the issuance of a Final Rejection, an interview was conducted with the Examiner on June 20, 1990. As the record indicates, at the interview and after a responsive Amendment, 3D submitted drawings to show how the web supports of the claimed invention differed from the prior art. FIG. 1 is provided below:



WEB SUPPORTS HAVE LENGTH SUBSTANTIALLY GREATER THAN WIDTH

On the drawing, the applicants designated the width, length and height dimensions and stated beneath the drawing: "*Web supports have length substantially greater than width.*"

7. **"Means For Receiving Said Support Representation, And For Forming Said Three-Dimensional Object Out of Said Medium Substantially Layer by Layer And Also For Forming Said Support Out Of Said Material Substantially Layer by Layer, In Accordance With Said Object and Support Representations"**

The parties agree that this clause is a means-plus-function clause and also agree that the identified functions are as follows:

- receiving the support representation;
- forming the three-dimensional object out of the medium; and
- forming the support out of the material substantially layer by layer in accordance with the object and support representations.

The means element of claim 35 describes the formation of both the object and support by the disclosed stereolithographic process. Thus, the means of claim 35 should be construed to mean "a computer programmed to receive data files representing (a) cross sections of the object and (b) cross sections of the support, a fluid medium capable of solidification in response to synergistic stimulation, and a source of synergistic stimulation to which the material is exposed to form successive solidified layers, each at the surface of the last formed building material layer and each representing an adjacent cross section of the object and support, respectively."

V. CONCLUSION

For all of the foregoing reasons, the Special Master recommends that the parties' claim construction disputes be resolved as concluded herein.

Respectfully submitted,

Dated: May 15, 2007

Robert Neuner
Special Master

CERTIFICATE OF SERVICE

I hereby certify that on May 15, 2007, I electronically filed the foregoing with the Clerk of the Court using the ECF system which will send notification of such filing to the following:

Susan M. Kornfield	skornfield@bodmanllp.com
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I declare under penalty of perjury that the foregoing statements are true and correct.

John Mitchell, Paralegal (212) 408-2560